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In situ imaging of a lattice Bose gas via Raman cooling[1] SRIVATSAN CHAKRAM, LAUREN AYCOCK, BENJAMIN NOSARZEWSKI, MUKUND VENGALATTORE, Cornell University — We present experimental results on the non-destructive imaging of a lattice Bose gas via fluorescence induced by two-photon transitions. We first realize rapid, all-optical Bose condensation of ^{87}Rb atoms through a combination of degenerate Raman sideband cooling and adiabatic manipulations of an optical dipole trap. The atoms are then confined in a far off-resonant optical lattice and subjected to a periodically modulated two-photon transition. This sequence has the combined effect of inducing fluorescence in the confined atoms while simultaneously cooling them to the ground state of the lattice. In contrast to the demonstrated lattice imaging techniques [1,2], our technique can be extended to atomic species that are less amenable to polarization-gradient cooling. In addition, the minimally destructive nature of our technique allows the time-resolved studies of such lattice-based atomic systems. The high rates of data acquisition, large condensed ensembles and non-destructive imaging techniques demonstrated in our system are ideally suited for metrology and studies of non-equilibrium many-body dynamics using degenerate atomic gases

[1] W. Bakr *et al*, Nature **462**, 72 (2009);
[2] J. F. Sherson *et al*, Nature **467**, 68 (2010);

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